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ESR evidence for partial melting of the orbital order in LaMnO3 below the Jahn-Teller transition

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Abstract

We report on high-temperature electron spin resonance studies of a detwinned LaMnO3 single crystal across the Jahn-Teller transition at TJT=750 K. The anisotropy of the linewidth and g factor reflects the local Jahn-Teller distortions in the orbitally ordered phase. A clear jump in the linewidth accompanies the Jahn-Teller transition at TJT=750 K confirming that the transition is of first order. Already at T*=550 K a significant decrease of the reduced linewidth is observed. This temperature scale is discussed with respect to the interaction of the eg electrons of the Mn3+ ions and the elastic field of the cooperative distortions. Our results support a partial melting of the orbital order along the antiferromagnetically coupled b axis at T*. The remaining two-dimensional orbital ordering within the ferromagnetically coupled ac plane finally disappears together with the cooperative distortion at TJT. Moreover, in our discussion we show that elastic strain field interactions can explain the melting of the orbital order and, thus, have to be taken into account to explain the orbital ordering in LaMnO3. © 2014 American Physical Society.

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